A simple method to measure MPRT by using experimental Gray to Gray response time curves.

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1. Introduction

One of the remaining disadvantages of Liquid crystal displays (LCDs) compared to CRT is the existence of motion blur. Motion picture quality of most of present LCDs is not adequate for high speed live images. There are two basic reasons for this: (1) the slow response time of LCs, and (2) the hold-type temporal rendering method of LCDs combined to the smooth pursuit eye movement of the human visual system. Conventionally the liquid crystal response time (LCRT) has been used as a quality parameter. However LCRT does not describe the perceived motion blur. To expressly describe motion blur, the response time of intermediate gray levels must be taken into account, and hence the index parameter Moving Picture Response Time (MPRT), for moving application has been defined recently [2].

2. Methodology

LCD luminance response is slower than the human eye response. Four methods for measuring this have been proposed: Pursuit camera method [4], Time based image integration approach [1], Pursuit mirror simulated method [3] and Moving picture simulation [1]. The three first measuring proposals are complicated and expensive, the fourth technique is only a simulation, and all of them require a commercial large programmable LCD.

Our proposal is to relate standard gray to gray response time experimental curves to MPRT. With a setup presented previously[5], we are able to measure intermediate gray to gray level response time (see Fig. 1).

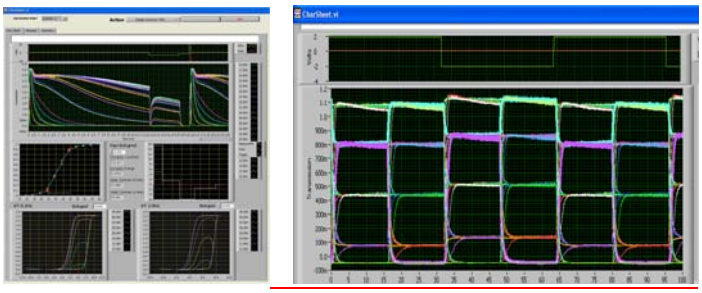

Fig. 1. Gray to Gray experimental response time curves.

A new software has been implemented to calculate the MPRT based on these curves only and two more parameters (T_f: Frame Period, v: scroll velocity) as input variables (see Fig. 2).

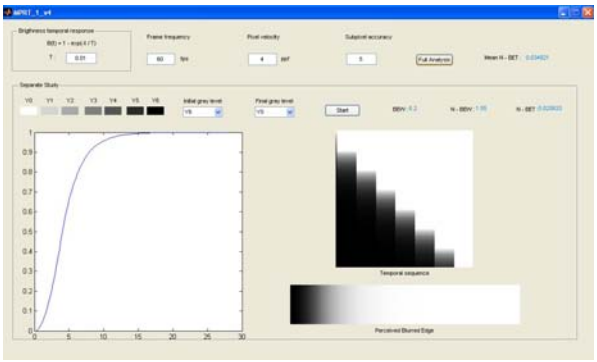

Fig. 2. User interface of the calculation software.

3. Results and Conclusions

The values obtained with this new measurement method are comparable to the ones measured with the expensive commercial systems. Another advantage of the proposal is that it can be used to measure MPRT in small test cells. The target of our system is its application in manufacturing process. The values of MPRT obtained with this procedure, could be taken into account by engineers during de design process to improve the moving quality of the final display.

4. References

[1] T. Yamamoto, S. Sasaki, Y. Igarashi, Y. Tanaka, "*Guiding principles for high-quality moving picture in LCD TVs"*, Journal of the SID, **14/10**, 933-939 (2006).

[2] Y. Igarshi, T. Yamamoto, Y. Tanaka, J. Someya, Y Nakamura, M. Yamakawa, Y. Nishida and T. Kurita, *"Summary of moving-picture response time (MPRT) and futures"*, SID Symposium Digest Tech Papers **35**, 1262-1265 (2004).

[3] J. Someya and H. Sugiura, *"Evaluation of liquid-crystal-display motion blur with moving-picture response time and human perception"*, Journal of the SID, **15/1**, 79-86, (2007).

[4] K. Oda, and A. Yuuki, EURO DISPLAY 6-7, (2002).

[5] M.A. Geday, X. Quintana, N. Bennis, B. Cerrolaza, D. Perez-Medialdea, J.M. Oton, "*Automated characterisation system for liquid crystal displays*", Proc. 2007 Spanish Conference On Electron Devices, 318-320, (2007).

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